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Langley Research Center



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The Thin Film Microwave Iris

The ability of a thin metallic film to support a tangential component of electric field at its surface makes it possible to construct microwave irises which will display a capacitive reactance where their exact counterpart constructed with a metal foil will appear as an inductive reactance.

A unique waveguide iris suitable for all types of microwave coupling applications has been devised. This thin film iris coupler exists in two basic forms:

1. The device is a passive iris coupler when the edges of the thin film are connected electrically to the walls of the waveguide. It may be used for impedance matching purposes or to connect sections of microwave systems together. It may be used as the coupling window in directional couplers, power splitters, and as a cavity coupler.
2. An active iris coupler is obtained if the edges of the film are insulated from the walls of the waveguide, except for connections at the upper and lower edges, and if these connections are made through microwave diodes or transistors. When the diodes or transistors are reverse biased, the film is disconnected electronically from the walls of the guide, and the power transmission through the film is at a maximum. When the diodes or transistors are forward biased, the film is grounded to the waveguide walls and the transmission is controlled by the σd product of the film as well as the shape and size of the iris opening in the film. The active iris coupler may be used as a modulator, phase shifter, and controlled coupler.

The introduction of thin conducting films into the fabrication of microwave devices opens a new area of research and development. Because thin conducting films have a finite conductivity (as contrasted to the almost perfect conductivity of most bulk metals) they can support an electric field. As a direct result of this phenomenon, the rectangular iris, which would normally be inductive, is now capacitive under predictable con-

ditions. Since the microwave impedance behavior of thin film can now be predicted, it is possible to design thin film active and passive microwave devices. The application of thin film (less than 1000 Å) microwave transmission windows as possible modulators or switches led to the introduction of a very small iris in the film in order to both improve the power transmission properties of the window and at the same time to reduce the experimentally observed standing waves.

Note:

The following documentation may be obtained from:
National Technical Information Service
Springfield, Virginia 22151
Single document price \$6.00
(or microfiche \$0.95)

Reference: NASA-CR-1364 (N69-28096), The Thin Film Iris

Patent status:

This invention has been patented by NASA (U.S. Patent No. 3,649,935). Inquiries concerning non-exclusive or exclusive license for its commercial development should be addressed to:

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